

I claim:

1. A self calibrating voltage regulation system comprising: /

- a. a first voltage reference;
- b. a second voltage reference, which has substantially less voltage stability  
5 than the first voltage reference;
- c. an error signal generator configured to be in communication with both the  
first voltage reference and a feedback voltage, the error signal generator  
being further configured to generate an error signal based thereon; and
- d. an error correction unit configured to be in communication with both the  
10 error signal and the second voltage reference, the error correction unit  
being further configured to generate a calibrated output voltage that has a  
greater voltage stability than the second voltage reference.

2. The voltage regulation system of claim 1, wherein the error signal generator  
comprises:

- a. a first comparison unit configured to be in communication with both the  
15 first voltage reference and the feedback voltage, the first comparison unit  
being further configured to output a first comparison signal;
- b. a first storage unit configured to selectively receive and store the first  
comparison signal;
- c. a second storage unit configured to selectively receive and store the first  
20 comparison signal;

- d. a storage control unit configured to control the selective receiving and storage of the first comparison signal in the first and second storage units; and
  - e. a second comparison unit configured to be in communication with both the first and second storage units, the second comparison unit being further configured to output the error signal, which error signal is based on comparing the values stored in the first and second storage units;
- 3. The voltage regulation system of claim 1, wherein the first voltage reference comprises a thermal resistor heated zener (TRZ) that is turned on during a sampling period and is otherwise essentially turned off, wherein the duration of the sampling period is selected to provide the first voltage reference substantially more voltage stability than the second voltage reference.
- 4. The voltage regulation system of claim 3, wherein the output voltage is calibrated during the sampling period, whereby the time between successive sampling periods is selected to maintain the output voltage calibration to within a desired tolerance.
- 5. The voltage regulation system of claim 3, wherein the second voltage reference comprises a TRZ, which is turned on with a sufficiently high on-time duty cycle such that the output voltage becomes out of calibration.
- 6. The voltage regulation system of claim 3, wherein the error signal generator comprises:

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- a. a first comparison unit configured to be in communication with both the first voltage reference and the feedback voltage, the first comparison unit being further configured to output a first comparison signal;
  - b. a first storage unit configured to selectively receive and store the first comparison signal;
  - c. a second storage unit configured to selectively receive and store the first comparison signal;
  - d. a storage control unit configured to control the selective receiving and storage of the first comparison signal in the first and second storage units, the storage control unit being further configured to synchronize the selective receiving with the sampling time; and
  - e. a second comparison unit configured to be in communication with both the first and second storage units, the second comparison unit being further configured to output the error signal, which error signal is based on comparing the values stored in the first and second storage units;
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7. The voltage regulation system of claim 6, wherein the feedback voltage is derived from the output voltage.
  8. The voltage regulation system of claim 6, wherein the first comparison unit comprises an analog difference amplifier.
  9. The voltage regulation system of claim 6, wherein the first and second storage units are implemented as digital storage registers.
  10. The voltage regulation system of claim 9, wherein the comparing done by the second comparison unit is a digital subtraction, whereby the error signal is an

analog signal substantially corresponding to the result of the digital subtraction of the first and second digital storage registers.

11. The voltage regulation system of claim 1, wherein the error correction unit comprises a summing amplifier.

5 12. The voltage regulation system of claim 1, wherein the error correction unit comprises a binary controlled scalar, which scalar appropriately scales the calibrated output voltage to a desired voltage value.

13. The voltage regulation system of claim 1, wherein the error correction unit comprises an output buffer configured to buffer the calibrated output voltage.

10 14. The voltage regulation system of claim 1, wherein the error signal generator is remotely located away from the error correction unit and the communication of the error signal to the error correction unit occurs via suitable communication means.

15. A self calibrating voltage regulation system comprising:

15 a. a first voltage reference comprising a thermal resistor heated zener (TRZ) that is turned on only during a sampling period and is otherwise essentially turned off, wherein the duration of the sampling period is selected to provide the first voltage reference substantially more voltage stability than a second voltage reference, which second voltage reference comprises a  
20 TRZ that is turned on with a sufficiently high on-time duty cycle such that its voltage becomes out of calibration;

- b. an error signal generator configured to be in communication with both the first voltage reference and a feedback voltage, the error signal generator being further configured to generate an error signal based thereon; and
  - c. an summing amplifier configured to be in communication with both the error signal and the second voltage reference, the summing amplifier being further configured to generate a calibrated output voltage that has a greater voltage stability than the second voltage reference.
16. The voltage regulation system of claim 15, wherein the feedback voltage is derived from the output voltage.
17. The voltage regulation system of claim 15, wherein the output voltage is calibrated during the sampling period, whereby the time between successive sampling periods is selected to maintain the output voltage calibration to within a desired tolerance.
18. The voltage regulation system of claim 15, wherein the error signal generator comprises:
- a. an analog difference amplifier configured to be in communication with both the first voltage reference and the feedback voltage, the first comparison unit being further configured to output a first comparison signal;
  - b. a first digital storage register configured to selectively receive and store the first comparison signal;
  - c. a second digital storage register configured to selectively receive and store the first comparison signal;

- d. a storage control unit configured to control the selective receiving and storage of the first comparison signal in the first and second storage units, the storage control unit being further configured to synchronize the selective receiving with the sampling time; and
- 5 e. a digital subtraction unit configured to be in communication with both the first and second digital storage registers, the digital subtraction unit being further configured to output the error signal, which error signal is an analog signal substantially corresponding to the result of the digital subtraction of the first and second digital storage registers;
- 10 19. The voltage regulation system of claim 15, wherein the error correction unit comprises a binary controlled scalar, which scalar appropriately scales the calibrated output voltage to a desired voltage value,
- 20. The voltage regulation system of claim 15, wherein the error correction unit comprises an output buffer configured to buffer the calibrated output voltage.
- 15 21. The voltage regulation system of claim 15, wherein error signal generator is remotely located away from the error signal generator and the communication of the error signal to the error correction unit occurs via suitable communication means.
- 22. A self calibrating voltage regulation system comprising: /
  - 20 a. a first voltage reference means that has substantially more voltage stability than a second voltage reference means;
  - b. an error signal generating means configured to be in communication with both the first voltage reference means and a feedback voltage; and

c. an error correction means configured to be in communication with both the error signal generating means and the second voltage reference means, the error correction means being further configured to generate a calibrated output voltage that has a greater voltage stability than the second voltage reference means.

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23. The voltage regulation system of claim 22, further comprising an auto-tracking means configured to set the output voltage reference to a specific voltage, whereby the error correction means is configured to maintain the specific voltage.

24. The voltage regulation system of claim 22, wherein the output voltage is calibrated during the sampling period, whereby the time between successive sampling periods is selected to maintain the output voltage calibration to within a desired tolerance.

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25. The voltage regulation system of claim 22, wherein the error signal generating means is remotely located away from the error correction means and the communication of the error signal to the error correction unit occurs via suitable communication means.

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26. A method the self calibrating and auto-tracking of an output voltage to be regulated, voltage regulation method comprising the steps of:

- a. turning on a first voltage reference during a sampling period and otherwise turning it essentially off;
- b. setting the duration of the sampling period to provide the first voltage reference substantially more voltage stability than a second voltage reference;

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- c. generating an error signal based on the first voltage reference and a feedback voltage; and
- d. calibrating the output voltage based on the error signal and the second voltage reference, whereby the calibrated output voltage has a greater voltage stability than the second voltage reference.

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27. The voltage regulation method of claim 26, further comprising the step of setting the on-time duty cycle of the second voltage reference sufficiently high such that its voltage becomes out of calibration;

28. The voltage regulation method of claim 26, wherein calibrating the output voltage occurs during the sampling period, whereby the time between successive sampling periods is selected to maintain the output voltage calibration to within a desired tolerance.

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29. The voltage regulation method of claim 26, wherein generating the error signal comprises the steps of:

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- a. subtracting the first voltage reference and the feedback voltage, thereby generating an analog difference signal;
- b. digitizing the analog difference signal;
- c. initializing a first digital storage register to a preset value corresponding to a target regulation voltage to maintain;
- d. storing the digitized analog difference signal in a second digital storage register; and
- e. generating the error signal by subtracting the first and second digital storage registers;

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30. The voltage regulation method of claim 26, wherein calibrating the output voltage comprises the step of adding together the error signal and the second voltage reference to generate the calibrated output voltage.
31. The voltage regulation method of claim 26, further comprising the step of scaling  
5 the calibrated output voltage to a desired voltage value.
32. The voltage regulation method of claim 26, further comprising the step of buffering the calibrated output voltage to substantially isolate it electrically from a load.